Size *is* everything

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As we stand on the threshold of the new Millennium it is worthwhile casting our eyes back for a few moments and acknowledging that we have come a long way in a very short time. Semiconductors are still really only half a century old. That equates to only 5% of a Millennium, whereas semiconductors will be the dominant industry of the next.

As far as III-Vs are concerned the pinnacle of achievement must surely be the 150 mm substrate. This is an impressive enough achievement in itself but it is what it represents that has the most portent for the future. The implementation of 150 mm marks the maturity of the GaAs IC industry: the time when it reached a standard on a par with that of silicon. But behind this mark there lurks an industry rent with less ordered structure and business professionalism.

As an illustration of this disorder one only has to consider the situation with 150 mm itself. It has come to be in common parlance as 'six-inch' wafers. This, however, is the tip of the iceberg. It reveals the casual use of an inexact description. Without going into too much detail, which would be inappropriate in this context, these GaAs disks have what is a very highly complex specification. Denoting them as 'six-inch' is not only inaccurate but also foregoes the precision and professionalism with which this development should be treated, being as it is a signpost of the seriousness with which some suppliers are treating the production of GaAs IC materials and devices.

Going back to the matter of units, there are, of course, those in the industry who prefer to use inches rather than millimetres. This should not be taken as an indicator of any anti-Gallic feeling but rather the dominance of the US way with all things in electronics. US electronics people have long thought of tolerances measured in 'thou' i.e. thousandths of an inch. While this is absurd on face value (since the basic root of this system is non-decimal), it is well-established and will take a long time to shake off.

Already, there are many users in this industry of ours who look over this situation with a wry scepticism. This has been the case for some time - you only have to look at the situation of opto with its preference for two-inch, or rather 50 mm, diameter wafers. Should a customer place an order for a two-inch diameter wafer then this at first glance looks perfectly acceptable. But to the wafer supplier this is only half the story and can lead to all kinds of trouble later on. For instance, the usual tolerance for such diameters is either +/-0.3 or +/-0.4 mm (metric again). As one industry veteran was heard to comment, it is not unusual for buyers to order 'two-inch' only to subsequently express their consternation when the wafer they receive is 50.8 mm and not 50.0 mm, the size they actually wanted in the first place.

Another industry trend of late has been the dubious move to offer 'two-inch' or 50 mm diameter process trial wafers as being 50.5 (+/- 0.5) mm in diameter. These wafers are likely to be perfectly acceptable for some applications - such as epitaxy - but could spell disaster for others. For example, they could cause problems if used in equipment that requires inverted mounting - such as contact metal evaporation - where they are held in place by their edges.

Some improvement in this situation came with the advent of the larger sizes of wafers. For 'three-inch', i.e. 75 mm, it is usual to consider using 76.2 mm in western practices, whereas in the east it is 76.0 mm. In both cases then, no-one is actually using 75 mm diameter wafers. It usually works out fine because most users have tolerances set at +/0.3 mm, which allows them to use either eastern or western styles - but this only begs the question as to why we haven't by now settled on an internationally agreed standard size...?

On to 'four-inch' now, when we should actually being saying 100 mm. This has become the standard so we do actually appear to be making progress after all. The industry seems to have not followed silicon into the dead-end that was 'five-inch', i.e. 125 mm, going straight to 150 mm. But silicon quickly moved onto 'eight-inch', i.e. 200 mm, rather than dally with 150 mm. Lucky for them that the materials process technology permitted them to do so. For GaAs, 150 mm is presently the technology limit. It looks set to remain so for probably another five years.

So one is left with the hope that the common sense that has prevailed with each step upwards in wafer diameter size will continue. Wafer diameter is but one aspect of the total wafer specification. With the dawn of the new era of 'silicon-like' professionalism in device mass production courtesy of the new operators of 150 mm lines, we can expect additional streamlining and standardization in wafer thickness and flat orientation (flat or notch) - not to mention laser mark position and format - before too long. No doubt the purchasing power of these factories will be a major force in pushing the substrate suppliers up this route as the new century unfolds.

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